CLAIMS

What is claimed is:

1. A phase-change heat exchanger, comprising:

a plurality of conduits configured to convey a fluid;

a foam structure in thermal contact with at least one of said plurality of conduits, said foam structure having a plurality of ligaments interconnected to form a three-dimensional reticulated structure of a plurality of open cells; and

a phase-change material contained within at least a portion of said plurality of open cells, said phase-change material configured to receive thermal energy of said fluid from said plurality of ligaments.

2. The phase-change heat exchanger of claim 1, further comprising an intake manifold configured to distribute the fluid to said plurality of conduits.

3. The phase-change heat exchanger of claim 1, further comprising an outlet manifold configured to collect the fluid from said plurality of conduits.

4. The phase-change heat exchanger of claim 1, wherein each of said plurality of conduits is fabricated from a material having a thermal conductivity greater than one (1) Btu-ft/hr-ft-ft-F.

5. The phase-change heat exchanger of claim 1, wherein each of said plurality of conduits is fabricated from Nickel 201.

6. The phase-change heat exchanger of claim 1, further comprising a protrusion within at least one of said plurality of conduits.

7. The phase-change heat exchanger of claim 1, further comprising a plurality of protrusions in each of said plurality of conduits that are configured to regulate flow of the fluid.

8. The phase-change heat exchanger of claim 1, wherein the open cells have polygonal shapes.

9. The phase-change heat exchanger of claim 1, wherein the foam structure has a reticulated structure of open, dodecahedronal-shaped cells connected by solid metal ligaments.

10. The phase-change heat exchanger of claim 1, wherein the foam structure is prepared from aluminum.

11. The phase-change heat exchanger of claim 1, wherein at least a portion of the foam structure is prepared from a carbon material.

12. The phase-change heat exchanger of claim 11, wherein said at least said portion of the foam structure is prepared from a mesophase pitch-based carbon.

13. The phase-change heat exchanger of claim 1, wherein the phase-change material has a latent heat of fusion that is greater than about twenty five (25) Btu/lb.

14. The phase-change heat exchanger of claim 1, wherein the phase-change material has a latent heat of fusion that is less than about one hundred and fifty (150) Btu/lb.

15. The phase-change heat exchanger of claim 1, wherein the phase-change material is a paraffinic hydrocarbon.

16. A Chemical Oxygen Iodine Laser (COIL), comprising:

a singlet oxygen generator that is configured to receive a chlorine gas, receive a Basic Hydrogen Peroxide (BHP) and produce an excited oxygen gas in a metastable state;

a laser nozzle that is configured to mix said excited oxygen gas and an iodine vapor in order to facilitate an energy transfer from said excited oxygen gas to said iodine vapor and produce an inverted population of exited iodine atoms in said iodine vapor;

a laser cavity configured to extract said inverted population of exited iodine atoms from said iodine atoms and produce a coherent laser light; and

a phase-change heat exchanger to thermally condition said BHP exiting said singlet oxygen generator, said phase-change heat exchanger comprising:

a plurality of conduits configured to convey said BHP;

a foam structure in thermal contact with at least one of said plurality of conduits, said foam structure having a plurality of ligaments interconnected to form a three-dimensional reticulated structure of a plurality of open cells; and

a phase-change material contained within at least a portion of said plurality of open cells, said phase-change material configured to receive thermal energy of said BHP from said plurality of ligaments.

17. The COIL of claim 16, wherein the phase-change material is a paraffinic hydrocarbon.

18. The COIL of claim 16, wherein the phase-change material is normal decane (n-decane).

19. The COIL of claim 16, wherein the phase-change material has a melting point that is greater than about thirty one degrees Celsius (-31˚C) and less than about thirty five degrees Celsius (-31˚C).

20. The COIL of claim 16, wherein the phase-change material has a latent heat of fusion of approximately one hundred (100) Btu/lb.

21. The COIL of claim 16, wherein the phase-change material is a eutectic composition of water and an aqueous salt solution.

22. The COIL of claim 16, wherein the foam structure has a reticulated structure of open, dodecahedronal-shaped cells connected by solid metal ligaments.

23. The COIL of claim 16, wherein the foam structure is prepared from aluminum.

24. The COIL of claim 16, wherein at least a portion of the foam structure is prepared from a carbon material.

25. The COIL of claim 16, wherein said at least said portion of the foam structure is prepared from a mesophase pitch-based carbon.